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☐	L6	L4 and compress$3 with synthesis gas with hydrogen	8
☐	L5	L4 and compress$3 with synthesis gas	31
☐	L4	L2 and carbon dioxide with carbon monoxide with hydrogen	265
☐	L3	L2 and carbon dioxide	414
☐	L2	L1 and synthesis gas	551
☐	L1	methanol with acetic acid	35084

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☐ 1. Document ID: US 6214066 B1

Using default format because multiple data bases are involved.

L6: Entry 1 of 8 File: USPT Apr 10, 2001

US-PAT-NO: 6214066
DOCUMENT-IDENTIFIER: US 6214066 B1

TITLE: Synthesis gas production by ion transport membranes

DATE-ISSUED: April 10, 2001

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nataraj; Shankar	Allentown	PA		
Russek; Steven Lee	Allentown	PA		

US-CL-CURRENT: 48/198.2; 422/239, 423/245.3, 423/418.2, 423/651, 48/127.5, 48/198.1, 95/45, 95/54

Full | Title | Citation | Front | Review | Classification | Date | Reference | [illegible] | Claims | KWMC | Draw De

☐ 2. Document ID: US 6110979 A

L6: Entry 2 of 8 File: USPT Aug 29, 2000

US-PAT-NO: 6110979
DOCUMENT-IDENTIFIER: US 6110979 A

TITLE: Utilization of synthesis gas produced by mixed conducting membranes

DATE-ISSUED: August 29, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nataraj; Shankar	Allentown	PA		
Russek; Steven Lee	Allentown	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Air Products and Chemicals, Inc.	Allentown	PA			02

APPL-NO: 09/ 157544 [PALM]
DATE FILED: September 21, 1998

PARENT-CASE:
CROSS-REFERENCE TO RELATED APPLICATIONS This application is a Continuation-in-Part of Ser. No. 08/997,642, filed on Dec. 23, 1997, U.S. Pat. No. 6,048,472, which is incorporated herein by reference.

INT-CL: [07] C01 B 3/26

US-CL-ISSUED: 518/704; 252/373, 423/652
US-CL-CURRENT: 518/704; 252/373, 423/652

FIELD-OF-SEARCH: 423/650, 423/652, 423/655, 423/656, 252/373, 518/704

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4079017	March 1978	Crawford et al.	252/373
4791079	December 1988	Hazbun	502/4
4793904	December 1988	Mazanec et al.	204/59R
4822521	April 1989	Fuderer	252/373
5160713	November 1992	Mazanec et al.	423/648.1
5276237	January 1994	Mieville	585/500
5306411	April 1994	Mazanec et al.	204/265
5356728	October 1994	Balachandran et al.	429/8
5536488	July 1996	Mansour et al.	423/652
5580497	December 1996	Balachandran et al.	252/519
5591315	January 1997	Mezanec et al.	205/462
5599383	February 1997	Dyer et al.	96/8

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0399833	November 1990	EP	
0732138	September 1996	EP	

OTHER PUBLICATIONS

Rostrup-Nielsen, J. et al., "Steam Reforming-Opportunities and Limits of the Technology", presented at the NATO ASI Study on Chemical Reactor Technology for Environmentally Safe Reactors and Predictors, Aug. 25-Sep. 5, 1991, Ontario, Canada.
Christiansen, T. S. et al. "Improve Syngas Production Using Autothermal Reforming", Hydrocarbon Processing, Mar. 1994, pp. 39-46.
Sundset, T. et al., "Evaluation of Natural Gas Based Synthesis Gas production Technologies", Catalysis Today 21 (1994), pp. 269-278, (No Month).
Reed, C.L. et al., "Production of Synthesis Gas by Partial Oxidation of Hydrocarbons" presented at the 86.sup.th AIChE meeting, Houston, Texas, Apr. 1-5,

1979.
Fong, F., "Texaco's HyTEX Process for High Pressure Hydrogen Production", presented at the KTI Symposium, Apr. 27, 1993, Caracas, Venezuela.
Osterrieth, P. J. et al., "Custom-Made Synthesis Gas Using Texaco's Partial Oxidation Technology", presented at the AIChE Spring National Meeting, New Orleans, LA, Mar. 9, 1988.
Balachandran, U. et al. "Ceramic Membranes For Methane Conversion", presented at the Coal Liquefaction and Gas Conversion Contractors, Review Conference, Sep. 7-8, 1994, Pittsburgh, PA.
Tsai, C.-Y. et al., "Simulation of a Nonisothermal Catalytic Membrane Reactor for Methane partial Oxidation to Syngas", Proceedings of the Third International Conference of Inorganic Membranes, Worcester, MA, Jul. 10-14, 1994.
Tsai, C.-Y. et al., "Modeling and Simulation of a Nonisothermal Catalytic Membrane Reactor", Chem. Eng Comm., 1995, vol. 134, pp. 107-132.
Tsai, C. Y., "Perovskite Dense Membrane Reactors for the Partial Oxidation of Methane to Synthesis Gas", May 1996 (published by UMI Dissertation Services).
Cromarty, B. J. et al., "The Application of Pre-Reforming Technology in the Production of Hydrogen", presented at the NPRA Annual Meeting, Mar. 21-23, 1993, San Antonio, Texas.
Foreman, J. M., et al., "The Benefits of pre-reforming in Hydrogen Production Plants", presented at th World Hydrogen Conference, Jun. 1992.
Cromarty, B. J., "Modern Aspects of Steam Reforming for Hydrogen Plants", presented at the World Hydrogen Confernece, Jun. 1992.
Mazanec, T. J., "Electropox Gas Reforming", Electrochemical Society Proceedings, vol. 95-24, 16 1997, pp. 16-28, (No Month).
U.S. application No. 08/721,640, Adler et al., filed Sep. 26, 1996.
U.S. application No. 08/997,642, Nataraj et al., filed Dec. 23, 1997.
U.S. application No. 08/870,012, Nataraj et al., filed Jun. 6, 1997.
U.S. application No. 09/141,909, Adler et al., filed Aug. 28, 1998.
U.S. application No. 09/157,712, Nataraj et al., filed Sep. 21, 1998.
Copy of European Search Report.

ART-UNIT: 174

PRIMARY-EXAMINER: Langel; Wayne

ATTY-AGENT-FIRM: Fernbacher; John M.

ABSTRACT:

Hydrocarbon feedstocks are converted into synthesis gas in a two-stage process comprising an initial steam reforming step followed by final conversion to synthesis gas in a mixed conducting membrane reactor. The steam reforming step converts a portion of the methane into synthesis gas and converts essentially all of the hydrocarbons heavier than methane into methane, hydrogen, and carbon oxides. The steam reforming step produces an intermediate feed stream containing methane, hydrogen, carbon oxides, and steam which can be processed without operating problems in a mixed conducting membrane reactor. The steam reforming and mixed conducting membrane reactors can be heat-integrated for maximum operating efficiency and produce synthesis gas with compositions suitable for a variety of final products. Synthesis gas produced by the methods of the invention is further reacted to yield liquid hydrocarbon or oxygenated organic liquid products.

29 Claims, 6 Drawing figures

☐ 3. Document ID: US 6077323 A

L6: Entry 3 of 8 File: USPT Jun 20, 2000

US-PAT-NO: 6077323
DOCUMENT-IDENTIFIER: US 6077323 A

TITLE: Synthesis gas production by ion transport membranes

DATE-ISSUED: June 20, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nataraj; Shankar	Allentown	PA		
Russek; Steven Lee	Allentown	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Air Products and Chemicals, Inc.	Allentown	PA			02

APPL-NO: 08/ 870012 [PALM]
DATE FILED: June 6, 1997

INT-CL: [07] C01 B 3/24, C01 B 31/18, B01 J 7/00, B01 D 53/22

US-CL-ISSUED: 48/198.1; 48/127.5, 48/127.7, 48/148.3, 422/235, 422/239, 423/418.2, 423/245.3, 252/3.73, 95/45, 95/54
US-CL-CURRENT: 48/198.1; 252/373, 422/235, 422/239, 423/245.3, 423/418.2, 48/127.5, 48/127.7, 48/198.3, 95/45, 95/54

FIELD-OF-SEARCH: 48/127.7, 48/198.1, 48/198.3, 95/45, 95/54, 422/198, 422/193, 422/207, 422/235, 422/239, 423/650, 423/651, 423/418.2, 423/245.3, 252/373

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4791079	December 1988	Hazbun	502/4
4793904	December 1988	Mazanec et al.	204/59R
4802958	February 1989	Mazanec et al.	204/80
4933054	June 1990	Mazanec et al.	204/80
5068058	November 1991	Bushinsky et al.	252/376
5160713	November 1992	Mazanec et al.	423/210
5276237	January 1994	Mieville	585/500
5306411	April 1994	Mazanec et al.	204/265
5356728	October 1994	Balachandran et al.	429/8
5364506	November 1994	Giir et al.	204/59
5534471	July 1996	Carolan et al.	502/4
5573737	November 1996	Balachandran et al.	422/211
5580497	December 1996	Balachandran et al.	252/519

5591315	January 1997	Mezanec et al.	205/462
5599383	February 1997	Dyer et al.	96/8
5846641	December 1998	Abeles et al.	428/312.8
5868918	February 1999	Adler et al.	205/615

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0732138	September 1986	EP	
0399833	November 1990	EP	
0438902	July 1991	EP	
0673675	September 1995	EP	
0682379	November 1995	EP	
0705790	April 1996	EP	
0766330	April 1997	EP	
WO9424065	October 1994	WO	

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Christiansen, T. S. et al. "Improve Syngas Production Using Autothermal Reforming", Hydrocarbon Processing, Mar. 1994, pp. 39-46.
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Fong, F., "Texaco's HyTEX Process for High Pressure Hydrogen Production", presented at the KTI Symposium, Apr. 27, 1993, Caracas, Venezuela.
Osterrieth, P. J. et al., "Custom-Made Synthesis Gas Using Texaco's Partial Oxidation Technology", presented at the AIChE Spring National Meeting, New Orleans, LA, Mar. 9, 1988.
Balachandran, U. et al. "Ceramic Membranes For Methane Conversion", presented at the Coal Liquefaction and Gas Conversion Contractors, Review Conference, Sep. 7-8, 1994, Pittsburgh, PA.
Tsai, C.-Y. et al., "Simulation of a Nonisothermal Catalytic Membrane Reactor for Methane partial Oxidation to Syngas", Proceedings of the Third International Conference of Inorganic Membranes, Worcester, MA, Jul. 10-14, 1994.
Tsai, C.-Y. et al., "Modeling and Simulation of a Nonisothermal Catalytic Membrane Reactor", Chem. Eng Comm., 1995, vol. 134, pp. 107-132.
Tsai, C. Y., "Perovskite Dense Membrane Reactors for the Partial Oxidation of Methane to Snythesis Gas", May 1996 (published by UMI Dissertation Services).
ten Elshof, J. E. et al., "Oxidative Coupling of Methane in a Mixed-Conducting Perovskite Membrane Reactor". Applied Catalysis A; General 130 (1995) 195-212.
Mazanec, T. J. et al., "Electropox: BP's Novel Oxidation Technology", The Role of Oxygen in Improving Chemical Processes, R. Soc. Chem. (1993), vol. 132, pp. 212-25.

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Mazanec, T. J., Electropox: BP's Novel Oxidation Technology, The Activation of Dioxygen and Homogeneous Catalytic Oxidation, Edited by D. H. R. Barton et al.,

Plenum Press, New York 1993, pp. 85-96.
Mazanec, T.J., "Prospects for Ceramic Electrochemical Reactors in Industry", Solid State Ionics, 70/71 (1994) 11-19, North Holland.
Mazanec, T. J., "Electropox Gas Reforming", Electrochemical Society Proceedings, vol. 95-24, 1997, pp. 16-28.
Balachandran, U. et al., "Development of a Ceramic Membrane for Upgrading Methane to High-Value-Added Clean Fuels", Prepr. Pap.--Am. Chem. Soc., Div. Fuel Chem. (1997), 42(2), 591-595.
Balachandran, U. et al., "Dense Ceramic Membranes for Converting Methane to Syngas", Electrochemical Society Proceedings (1997), vol. 95-24, pp. 29-36.
Balachandran, U. et al., "Mixed-Conducting Ceramic Membranes for Partial Oxygenation of Methan", Ceram., Trans. (1996) 65(Role of Ceramics in Advanced Electrochemical Systems), 23-35.
Schwartz, M. et al, "The Use of Ceramic Membrane Reactors for The Partial Oxidation of Methane to Synthesis Gas", Prepr. Pap.--Am. Chem. Soc, Div. Fuel chem. (1997), 42(2) 596-600.
Ma Y. H., et al. "The Partial Oxidation of Methane to Synthesis Gas by Oxygen Selective Dense Perovskite Membrane Reactors", Presented at the AIChE 1997 Spring National Meeting, Houston, TX--Mar. 9-13, 1997.
Schwartz, M., et al., "The Use of Ceramic Membrane Reactors for the Partial Oxidation of Methane to Synthesis Gas", Presented at the AIChE 1997 Spring national Meeting, Houston, TX--Mar. 9-13, 1997.
Udovich, C. A., et al., "Ceramic Membrane Reactor for the Partial Oxygenation of Methane to Synthesis Gas", Presented at the AIChE 1997 Spring National Meeting, Houston, TX--Mar. 9-13, 1997.

ART-UNIT: 174

PRIMARY-EXAMINER: Tran; Hien

ASSISTANT-EXAMINER: Kennedy; James

ATTY-AGENT-FIRM: Fernbacher; John M.

ABSTRACT:

Synthesis gas is produced from a methane-containing reactant gas in a mixed conducting membrane reactor in which the reactor is operated to maintain the product gas outlet temperature above the reactant gas feed temperature wherein the total gas pressure on the oxidant side of the membrane is less than the total gas pressure on the reactant side of the membrane. Preferably, the reactant gas feed temperature is below a maximum threshold temperature of about 1400.degree. F. (760.degree. C.), and typically is between about 950.degree. F. (510.degree. C.) and about 1400.degree. F. (760.degree. C.). The maximum temperature on the reactant side of the membrane reactor is greater than about 1500.degree. F. (815.degree. C.).

31 Claims, 6 Drawing figures

☐ 4. Document ID: US 6066307 A

L6: Entry 4 of 8 File: USPT May 23, 2000

US-PAT-NO: 6066307
DOCUMENT-IDENTIFIER: US 6066307 A

TITLE: Method of producing hydrogen using solid electrolyte membrane

DATE-ISSUED: May 23, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Keskar; Nitin Ramesh	Grand Island	NY	14072	
Prasad; Ravi	East Amherst	NY	14051	
Gottzmann; Christian Friedrich	Clarence	NY	14031	

APPL-NO: 09/ 396199 [PALM]
DATE FILED: September 15, 1999

PARENT-CASE:
This application is a continuation of application Ser. No. 08/848,200 filed Apr. 29, 1997, abandoned.

INT-CL: [07] C01 B 3/02, C01 B 3/24, C01 B 3/26

US-CL-ISSUED: 423/648.1; 252/373, 423/650, 423/651, 423/652
US-CL-CURRENT: 423/648.1; 252/373, 423/650, 423/651, 423/652

FIELD-OF-SEARCH: 423/648.1, 423/650, 423/651, 423/652, 252/373

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3901669	August 1975	Seiter	55/16
4120663	October 1978	Fally	422/198
4536196	August 1985	Harris	423/650
4810485	March 1989	Marianowski et al.	423/648.1
5160713	November 1992	Mazanec et al.	204/265
5215729	June 1993	Boxbaum	423/648.1
5276237	January 1994	Mieville	423/418.2
5306411	April 1994	Mazanec et al.	204/265
5637259	June 1997	Galuszka et al.	423/650
5733435	March 1998	Prasad et al.	205/765

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0748648	December 1996	EP	
0778069	November 1997	EP	
1242401	September 1989	JP	

OTHER PUBLICATIONS

Balachandran et al., "Fabrication and Characterization of Dense Ceramic Membranes for Partial Oxidation of Methane", Proc. of Coal Liquefaction and Gas Conversion Contractors 'Review Conference, Pittsburgh, PA (Aug. 29-31, 1995).
Balachandran et al., "Dense Ceramic Membranes for Converting Methane to Syngas", First International Conference on Ceramic Membranes, 188.sup.th meeting to the Electrochemical Society, Inc., Chicago, IL (Oct. 8-13, 1995).
T. J. Mazanec, "Electropox: BP'Novel Oxidation Technology", in The Activation of Dioxygen and Homogeneous Catalytic Oxidation (D. Barton et al., eds), pp. 85-96, Plenum Press, NY 1993. (No Month).
Nozaki et al., "Oxide Ion Transport for Selective Oxidation Coupling of Methane with New Membrane Reactor", AIChE J., vol. 40, No. 5, pp. 870-877 (1994). (No Month).
Nagamoto et al., "Methane Oxidation by Oxygen Transported Through Solid Electrolyte" J. Catal., vol. 126 pp. 671-673 (1990). (No Month).

ART-UNIT: 174

PRIMARY-EXAMINER: Langel; Wayne

ATTY-AGENT-FIRM: Lau; Bernard

ABSTRACT:

A process for producing synthesis gas and hydrogen by passing a compressed and heated oxygen-containing gas mixture into a reactor having at least one solid electrolyte oxygen ion transport membrane to separate transported oxygen Organic fuel reacts with the oxygen to form synthesis gas. The resulting synthesis gas is separated into hydrogen gas through at least one solid electrolyte hydrogen transport membrane to separate the transported hydrogen in the same or different separator.

19 Claims, 2 Drawing figures

☐ 5. Document ID: US 6048472 A

L6: Entry 5 of 8 File: USPT Apr 11, 2000

US-PAT-NO: 6048472
DOCUMENT-IDENTIFIER: US 6048472 A

TITLE: Production of synthesis gas by mixed conducting membranes

DATE-ISSUED: April 11, 2000

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Nataraj; Shankar	Allentown	PA		
Moore; Robert Byron	Allentown	PA		
Russek; Steven Lee	Allentown	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE

Air Products and Chemicals, Inc. Allentown PA 02

APPL-NO: 08/ 997642 [PALM]
DATE FILED: December 23, 1997

INT-CL: [07] C01 B 3/26

US-CL-ISSUED: 252/373; 423/650, 423/652
US-CL-CURRENT: 252/373; 423/650, 423/652

FIELD-OF-SEARCH: 423/650, 423/652, 423/655, 423/656, 252/373

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
4079017	March 1978	Crawford et al.	252/373
4791079	December 1988	Hazbun	502/4
4793904	December 1988	Mazanec et al.	204/59R
4822521	April 1989	Fuderer	252/376
5160713	November 1992	Mazanec et al.	252/373
5276237	January 1994	Mieville	585/500
5306411	April 1994	Mazanec et al.	204/265
5356728	October 1994	Balachandran et al.	429/8
5536488	July 1996	Mansour et al.	423/652
5580497	December 1996	Balachandran et al.	252/519
5591315	January 1997	Mezanec et al.	205/462
5599383	February 1997	Dyer et al.	96/8
5714091	February 1998	Mazanec et al.	252/373
5868918	February 1999	Adler et al.	205/615

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
0399833	November 1990	EP	
0732138	September 1996	EP	

OTHER PUBLICATIONS

Rostrup-Nielsen, J. et al., "Steam Reforming-Opportunities and Limits of the Technology", presented at the NATO ASI Study on Chemical Reactor Technology for Environmentally Safe Reactors and Predictors, Aug. 25-Sep. 5, 1991, Ontario, Canada.
Christiansen, T. S. et al. "Improve Syngas Production Using Autothermal Reforming", Hydrocarbon Processing, Mar. 1994, pp. 39-46.
Sundset, T. et al., "Evaluation of Natural Gas Based Synthesis Gas Production Technologies", Catalysis Today 21 (1994), pp. 269-278.
Reed, C. L. et al. "Production of Synthesis Gas by Partial Oxidation of Hydrocarbons" presented at the 86.sup.th AIChE meeting, Houston, Texas, Apr. 1-5,

1979.
Fong, F., "Texaco's HyTEX Process for High Pressure Hydrogen Production", presented at the KTI Symposium, Apr. 27, 1993, Caracas, Venezuela.
Osterrieth, P. J. et al., "Custom-Made Synthesis Gas Using Texaco's Partial Oxidation Technology", presented at the AIChE Spring National Meeting, New Orleans, LA, Mar. 9, 1988.
Balachandran, U. et al. "Ceramic Membranes For Methane Conversion", presented at the Coal Liquefaction and Gas Conversion Contractors, Review Conference, Sep. 7-8, 1994, Pittsburgh, PA.
Tsai, C.-Y. et al., "Simulation of a Nonisothermal Catalytic Membrane Reactor for Methane partial Oxidation to Syngas", Proceedings of the Third International Conference of Inorganic Membranes, Worcester, MA, Jul. 10-14, 1994.
Tsai, C.-Y. et al., "Modeling and Simulation of a Nonisothermal Catalytic Membrane Reactor", Chem. Eng Comm., 1995, vol.. 134, pp. 107-132.
Tsai, C. Y., "Perovskite Dense Membrane Reactors for the Partial Oxidation of Methane to Synthesis Gas", May 1996 (published by UMI Dissertation Services).
Cromarty, B. J., et al., "The Application of Pre-Reforming Technology in the Production of Hydrogen", presented at the NPRA Annual Meeting, Mar. 21-23, 1993, San Antonio, Texas.
Foreman, J. M., et al., "The Benefits of pre-reforming in Hydrogen Production Plants", presented at th World Hydrogen Conference, Jun. 1992.
Cromarty, B. J., "Modern Aspects of Steam Reforming for Hydrogen Plants", presented at the World Hydrogen Confernece, Jun. 1992.
Mazanec, T. J., "Electropox Gas Reforming", Electrochemical Society Proceedings, vol. 95-24, 16 1997, pp 16-28.
U.S. application No. 08/721,640, Adler et al., filed Sep. 26, 1996.
Copy of European Search Report.

ART-UNIT: 174

PRIMARY-EXAMINER: Langel; Wayne

ATTY-AGENT-FIRM: Fernbacher; John M.

ABSTRACT:

Hydrocarbon feedstocks are converted into synthesis gas in a two-stage process comprising an initial steam reforming step followed by final conversion to synthesis gas in a mixed conducting membrane reactor. The steam reforming step converts a portion of the methane into synthesis gas and converts essentially all of the hydrocarbons heavier than methane into methane, hydrogen, and carbon oxides. The steam reforming step produces an intermediate feed stream containing methane, hydrogen, carbon oxides, and steam which can be processed without operating problems in a mixed conducting membrane reactor. The steam reforming and mixed conducting membrane reactors can be heat-integrated for maximum operating efficiency and produce synthesis gas with compositions suitable for a variety of final products.

28 Claims, 6 Drawing figures

☐ 6. Document ID: US 5865023 A

L6: Entry 6 of 8 File: USPT Feb 2, 1999

US-PAT-NO: 5865023

DOCUMENT-IDENTIFIER: US 5865023 A

TITLE: Gasification combined cycle power generation process with heat-integrated chemical production

DATE-ISSUED: February 2, 1999

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Sorensen; James Christian	Allentown	PA		
Scharpf; Eric William	Perkasie	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Air Products and Chemicals, Inc.	Allentown	PA			02

APPL-NO: 08/ 909565 [PALM]
DATE FILED: August 12, 1997

PARENT-CASE:
This is a division of application Ser. No. 08/259,649 filed Jun. 14, 1994 now U.S. Pat. No. 5,666,800.

INT-CL: [06] F02 G 3/00, F02 C 3/20

US-CL-ISSUED: 60/39.02; 60/39.05, 60/39.463, 60/39.53, 60/39.59, 60/39.12
US-CL-CURRENT: 60/775; 60/39.12, 60/39.463, 60/39.53, 60/39.59, 60/780, 60/783

FIELD-OF-SEARCH: 60/39.02, 60/39.05, 60/39.07, 60/39.12, 60/39.463, 60/39.53, 60/39.59

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3788066	January 1974	Nebgen	60/39.05
3796045	March 1974	Foster-Pegg	60/39.02
3877218	April 1975	Nebgen	60/39.05
4273743	June 1981	Barber	422/148
4277416	July 1981	Grant	518/793
4424667	January 1984	Fanning	60/39
4590760	May 1986	Goebel et al.	60/39.12
4608818	September 1986	Goebel et al.	60/39.12
4631915	December 1986	Frewer et al.	60/39.12
4663931	May 1987	Schiffers et al.	60/39.07
4665688	May 1987	Schiffers et al.	60/39.07
4676063	June 1987	Goebel et al.	60/39.07
4722190	February 1988	Yamamoto et al.	60/648
5179129	January 1993	Studer	518/700

5251433	October 1993	Wallace	60/39.05
5295351	March 1994	Rathbone	60/39.05
5319924	June 1994	Wallace et al.	60/39.02
5388395	February 1995	Scharpf et al.	60/39.02
5394686	March 1995	Child et al.	60/39.02
5406786	April 1995	Scharpf et al.	60/39.05
5421166	June 1995	Allam et al.	62/649
5582029	December 1996	Occhiallini et al.	62/648
5722259	March 1998	Sorenson et al.	60/39.12

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
853010	April 1985	SA	
2075124	November 1981	GB	

ART-UNIT: 376

PRIMARY-EXAMINER: Freay; Charles G.

ATTY-AGENT-FIRM: Fernbacher; John M.

ABSTRACT:

A method for improving the efficiency of a gasification combined cycle system for the coproduction of electric power and one or more chemical or liquid fuel products from a synthesis gas feed containing hydrogen and carbon monoxide. Waste heat is recovered from the chemical reaction system in the form of heated water which is used to heat and humidify one or more gas streams introduced into the combustor of the combined cycle system gas turbine. Waste refrigeration recovered from the synthesis gas purification system optionally is used to cool the air inlet to the gas turbine compressor.

17 Claims, 4 Drawing figures

☐ 7. Document ID: US 5666800 A

L6: Entry 7 of 8 File: USPT Sep 16, 1997

US-PAT-NO: 5666800
DOCUMENT-IDENTIFIER: US 5666800 A

TITLE: Gasification combined cycle power generation process with heat-integrated chemical production

DATE-ISSUED: September 16, 1997

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Sorensen; James Christian	Allentown	PA		
Scharpf; Eric William	Perkasie	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Air Products and Chemicals, Inc.	Allentown	PA			02

APPL-NO: 08/ 259649 [PALM]
DATE FILED: June 14, 1994

INT-CL: [06] F02 G 3/00, F02 C 3/20

US-CL-ISSUED: 60/39.02; 60/39.05, 60/39.463, 60/39.12, 60/39.59
US-CL-CURRENT: 60/781; 60/39.463, 60/39.59, 60/775

FIELD-OF-SEARCH: 60/39.02, 60/39.05, 60/39.463, 60/39.53, 60/39.59, 60/39.12

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
3788066	January 1974	Nebgen	60/39.05
3796045	March 1974	Foster-Pegg	60/39.02
3877218	April 1975	Nebgen	60/39.05
4273743	June 1981	Barber et al.	422/148
4277416	July 1981	Grant	518/703
4424667	January 1984	Fanning	60/39.181
4590760	May 1986	Goebel et al.	60/39.12
4608818	September 1986	Goebel et al.	60/39.12
4631915	December 1986	Frewer et al.	60/39.12
4663931	May 1987	Schiffers et al.	60/39.07
4665688	May 1987	Schiffers et al.	60/39.07
4676063	June 1987	Goebel et al.	60/39.07
4722190	February 1988	Yamamoto et al.	60/39.53
5179129	January 1993	Studer	518/700
5295351	March 1994	Rathbone	60/39.53
5319924	June 1994	Wallace et al.	60/39.02
5394686	March 1995	Child et al.	60/39.02
5406786	April 1995	Scharpf et al.	60/39.53

FOREIGN PATENT DOCUMENTS

FOREIGN-PAT-NO	PUBN-DATE	COUNTRY	US-CL
853010	April 1985	ZA	
2075124	November 1981	GB	

ART-UNIT: 343

PRIMARY-EXAMINER: Freay; Charles G.

ATTY-AGENT-FIRM: Fernbacher; John M.

ABSTRACT:

A method for improving the efficiency of a gasification combined cycle system for the coproduction of electric power and one or more chemical or liquid fuel products from a synthesis gas feed containing hydrogen and carbon monoxide. Waste heat is recovered from the chemical reaction system in the form of heated water which is used to heat and humidify one or more gas streams introduced into the combustor of the combined cycle system gas turbine. Waste refrigeration recovered from the synthesis gas purification system optionally is used to cool the air inlet to the gas turbine compressor.

2 Claims, 4 Drawing figures

☐ 8. Document ID: US 5179129 A

L6: Entry 8 of 8 File: USPT Jan 12, 1993

US-PAT-NO: 5179129
DOCUMENT-IDENTIFIER: US 5179129 A
**** See image for Certificate of Correction ****

TITLE: Staged liquid phase methanol process

DATE-ISSUED: January 12, 1993

INVENTOR-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY
Studer; David W.	Wescosville	PA		

ASSIGNEE-INFORMATION:

NAME	CITY	STATE	ZIP CODE	COUNTRY	TYPE CODE
Air Products and Chemicals, Inc.	Allentown	PA			02

APPL-NO: 07/ 664178 [PALM]
DATE FILED: March 1, 1991

INT-CL: [05] C07C 27/06, C07C 27/08

US-CL-ISSUED: 518/700; 518/706
US-CL-CURRENT: 518/700; 518/706

FIELD-OF-SEARCH: 518/700, 518/706

PRIOR-ART-DISCLOSED:

U.S. PATENT DOCUMENTS

PAT-NO	ISSUE-DATE	PATENTEE-NAME	US-CL
2467802	April 1949	Barr	
2852350	September 1958	Kolbel et al.	23/288
4540712	September 1985	Dombek	518/700
4608818	September 1986	Goebel et al.	60/39.12
4665688	May 1987	Schiffers et al.	60/39.07
4766154	August 1988	Bonnell et al.	518/700
4946477	August 1990	Perka et al.	48/197

ART-UNIT: 126

PRIMARY-EXAMINER: Mars; Howard T.

ATTY-AGENT-FIRM: Fernbacher; John M. Simmons; James C. Marsh; William F.

ABSTRACT:

Methanol is produced from synthesis gas comprising hydrogen, carbon monoxide, and carbon dioxide in a two-stage liquid phase reactor system. Each reactor is operated in an optimum temperature range to maximize methanol productivity, and once-through product conversion of up to 9.1 moles methanol per 100 moles of synthesis gas can be achieved with reasonable catalyst utilization. Overall catalyst utilization is increased by countercurrent catalyst transfer. In an alternate mode of operation, the liquid phase reactor system is integrated with a coal gasification combined cycle (CGCC) power generation process wherein the unreacted synthesis gas is used as fuel in a gas turbine-driven electric power generator. Operation of each liquid phase reactor in the optimum temperature range maximizes the available heat of reaction which is recovered as steam; the steam is utilized in the gas turbine combustor or the CGCC steam turbine. Methanol from the liquid phase reactor system can be used as peak shaving fuel for the gas turbine.

14 Claims, 4 Drawing figures

Term	Documents
SYNTHESIS	436074
SYNTHESES	38632
GAS	2543006
GASES	618605
HYDROGEN	1002455
HYDROGENS	22187
COMPRESS$3	0

COMPRESS	344675
COMPRESSA	170
COMPRESSAB	2
COMPRESSABI	1
(L4 AND COMPRESS$3 WITH SYNTHESIS GAS WITH HYDROGEN).PGPB,USPT,USOC,EPAB,JPAB,DWPI.	8

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NEWS	7	AUG 27	BIOCOMMERCE: Changes and enhancements to content coverage
NEWS	8	AUG 27	BIOTECHABS/BIOTECHDS: Two new display fields added for legal status data from INPADOC
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FILE COVERS 1907 - 17 Oct 2004  VOL 141 ISS 17
FILE LAST UPDATED: 15 Oct 2004  (20041015/ED)

  This file contains CAS Registry Numbers for easy and accurate
  substance identification.


=> s methanol (l) acetic acid
        171281 METHANOL
           668 METHANOLS
        171633 METHANOL
                  (METHANOL OR METHANOLS)
        206424 ACETIC
            22 ACETICS
        206433 ACETIC
                  (ACETIC OR ACETICS)
       3882956 ACID
       1449655 ACIDS
       4353917 ACID
                  (ACID OR ACIDS)
        181400 ACETIC ACID
                  (ACETIC(W)ACID)
L1        3894 METHANOL (L) ACETIC ACID

=> s l1 and synthesis gas
       1145263 SYNTHESIS
             3 SYNTHESISES
         62662 SYNTHESES
       1180726 SYNTHESIS
                  (SYNTHESIS OR SYNTHESISES OR SYNTHESES)
       1383365 GAS
        476149 GASES
       1554119 GAS
                  (GAS OR GASES)
         14920 SYNTHESIS GAS
                  (SYNTHESIS(W)GAS)
L2          66 L1 AND SYNTHESIS GAS

=> s l2 and (carbon monoxide (l) carbon dioxide (l) hydrogen)
       1080374 CARBON
         24057 CARBONS
       1089138 CARBON
                  (CARBON OR CARBONS)
        161809 MONOXIDE
           963 MONOXIDES
        162321 MONOXIDE
                  (MONOXIDE OR MONOXIDES)
        136816 CARBON MONOXIDE
```

```
                (CARBON(W)MONOXIDE)
       1080374 CARBON
         24057 CARBONS
       1089138 CARBON
                (CARBON OR CARBONS)
        419201 DIOXIDE
          6367 DIOXIDES
        420807 DIOXIDE
                (DIOXIDE OR DIOXIDES)
        196199 CARBON DIOXIDE
                (CARBON(W)DIOXIDE)
        839736 HYDROGEN
          5431 HYDROGENS
        842790 HYDROGEN
                (HYDROGEN OR HYDROGENS)
          1705 CARBON MONOXIDE (L) CARBON DIOXIDE (L) HYDROGEN
L3           6 L2 AND (CARBON MONOXIDE (L) CARBON DIOXIDE (L) HYDROGEN)

=> d l3 ibib ab 1-6

L3   ANSWER 1 OF 6  CAPLUS  COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER:         2004:691478  CAPLUS
DOCUMENT NUMBER:          141:192262
TITLE:                    Methanol plant retrofit for the manufacture
                          of acetic acid
INVENTOR(S):              Vidalin, Kenneth Ebenes; Thiebaut, Daniel Marcel
PATENT ASSIGNEE(S):       Acetex Cyprus Limited, Cyprus
SOURCE:                   U.S., 16 pp., Cont.-in-part of U.S. 6,232,352.
                          CODEN: USXXAM
DOCUMENT TYPE:            Patent
LANGUAGE:                 English
FAMILY ACC. NUM. COUNT:   3
PATENT INFORMATION:

     PATENT NO.           KIND   DATE        APPLICATION NO.         DATE
     ---------------      ----   --------    --------------------    --------
     US 6781014            B1    20040824    US 2002-129038          20020430
     US 6274096            B1    20010814    US 1999-430888          19991101
     US 6232352            B1    20010515    US 2000-547831          20000412
     WO 2001032594         A1    20010510    WO 2000-CY4             20001031
         W:  AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN,
             CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR,
             HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT,
             LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU,
             SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN,
             YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM
         RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY,
             DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ,
             CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG
PRIORITY APPLN. INFO.:                    US 1999-430808      A2 19991101
                                          US 1999-430888      A2 19991101
                                          US 2000-547831      A2 20000412
                                          WO 2000-CY4         W  20001031
AB   The retrofitting of an existing methanol or methanol
     /ammonia plant to make acetic acid is described.  The
     existing plant has a reformer into which natural gas or another
     hydrocarbon and steam (water) are fed.  Synthesis gas
     is formed in the reformer.  All or part of the synthesis
     gas is processed to sep. out carbon dioxide,
     carbon monoxide and hydrogen, and the separated
     carbon dioxide is the exiting to the existing
     methanol synthesis loop for methanol synthesis, or back
     into the feed to the reformer to enhance carbon monoxide
     formation in the synthesis gas.  Any remaining
```

synthesis gas not fed into the **carbon dioxide** separator can be converted to **methanol** in the existing **methanol** synthesis loop along with **carbon dioxide** from the separator and/or imported **carbon dioxide**, and **hydrogen** from the separator. The separated **carbon monoxide** is then reacted with **methanol** to produce **acetic acid** or an **acetic acid** precursor by a conventional process.

REFERENCE COUNT: 40 THERE ARE 40 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L3 ANSWER 2 OF 6 CAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 2002:569124 CAPLUS
DOCUMENT NUMBER: 137:386864
TITLE: Production of fuel by thermochemical transformation of biomass
AUTHOR(S): Claudet, Gerard
CORPORATE SOURCE: Direction l'energie nucleiare, CEA, Grenoble, Fr.
SOURCE: Clefs CEA (2001), Volume Date 2000-2001, 44, 16-20
CODEN: CEACES; ISSN: 0298-6248
PUBLISHER: Commissariat a l'Energie Atomique
DOCUMENT TYPE: Journal; General Review
LANGUAGE: French

AB A review on the need, availability, and current technologies for thermochem. transformation of biomass into fuels. The use of biomass as an energy and **hydrogen** source is becoming a major force in society. Biomass can be used (1) for combustion, with accompanying sulfur and nitrogen oxide pollution, as well as energy cogeneration, (2) with methanization to methane and **carbon dioxide** by anaerobic fermentation using animal manure and household waste, (3) for aerobic fermentation of saccharidic products such as cane sugar, amylase, and starches, to form ethanol, and (4)and thermochem. transformation, a gasification of lignocellulosic materials such as forests or straw. This route presents the most promising energy source. A chart is included outlining the power-producing processes and their biomass sources. One lignocellulosic gasification to normal methane, **hydrogen**, and **carbon monoxide** fuel gas is outlined with the various process temps. involved, starting with wet cellulose, hemicellulose, lignin, fumaric and maleic acids, **acetic acid**, formic acid, acetone, **methanol**, Me acetate, phenol, creosote, tar, and char or charcoal. The fuel gases can be further processes by combustion, synthesis to fuels such as di-Me ether and **methanol**, or the **hydrogen** purified. Specific catalysts were not mentioned.

L3 ANSWER 3 OF 6 CAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 2002:505214 CAPLUS
DOCUMENT NUMBER: 137:64902
TITLE: Bimodal **acetic acid** manufacture in **methanol** plants
INVENTOR(S): Vidalin, Kenneth Ebenes
PATENT ASSIGNEE(S): USA
SOURCE: U.S. Pat. Appl. Publ., 22 pp.
CODEN: USXXCO
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2002085963	A1	20020704	US 2000-751240	20001229
US 6531630	B2	20030311		
PRIORITY APPLN. INFO.:			US 2000-751240	20001229

AB The converting of an existing **methanol** plant to make

acetic acid is disclosed. The converted plant utilizes a steam reformer to which (a) a hydrocarbon, e.g., natural gas, or a lower alkanol, e.g., **methanol**, and (b) steam (water) are fed. Syngas is formed in the reformer. All or part of the syngas is processed to sep. out **carbon dioxide**, **carbon monoxide** and **hydrogen**, and the separated **carbon dioxide** is fed either to the existing **methanol** synthesis loop for **methanol** synthesis, or back into the feed to the reformer to enhance **carbon monoxide** formation in the syngas. When a lower alkanol is fed to the reformer, the **methanol** synthesis loop is shutdown and isolated from the rest of the plant. Any remaining syngas not fed to the **carbon dioxide** separator can be converted to **methanol** in the existing **methanol** synthesis loop along with **carbon dioxide** from the separator and/or imported **carbon dioxide**, and **hydrogen** from the separator. The separated **carbon monoxide** is then reacted with the **methanol** to produce **acetic acid** or an **acetic acid** precursor by a conventional process. When the **methanol** synthesis loop is shutdown, an imported source of **methanol** is used.

L3 ANSWER 4 OF 6 CAPLUS COPYRIGHT 2004 ACS on STN
ACCESSION NUMBER: 2001:352292 CAPLUS
DOCUMENT NUMBER: 134:328212
TITLE: **Methanol** plant retrofit for **acetic acid** manufacture
INVENTOR(S): Vidalin, Kenneth Ebenes
PATENT ASSIGNEE(S): Acetex Limited, Cyprus
SOURCE: U.S., 17 pp., Cont.-in-part of U.S. Ser. No. 430,888.
CODEN: USXXAM
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 3
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 6232352	B1	20010515	US 2000-547831	20000412
US 6274096	B1	20010814	US 1999-430888	19991101
WO 2001032594	A1	20010510	WO 2000-CY4	20001031
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG				
EP 1226103	A1	20020731	EP 2000-972559	20001031
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL				
NZ 519314	A	20031031	NZ 2000-519314	20001031
US 6353133	B1	20020305	US 2001-851915	20010509
NO 2002002063	A	20020626	NO 2002-2063	20020430
US 6781014	B1	20040824	US 2002-129038	20020430
PRIORITY APPLN. INFO.:			US 1999-430888 A2	19991101
			US 1999-430808 A2	19991101
			US 2000-547831 A	20000412
			WO 2000-CY4 W	20001031

AB The retrofitting of an existing **methanol** or **methanol** /ammonia plant to make **acetic acid** is disclosed. The existing plant has a reformer to which natural gas or another hydrocarbon

and steam (water) are fed for the generation of **synthesis gas** (i.e., CO, H2, CO2) via steam reforming. All or part of the produced **synthesis gas** is processed to sep. out **carbon dioxide**, **carbon monoxide**, and **hydrogen**, and the separated **carbon dioxide** is fed either to the existing **methanol** synthesis loop for **methanol** synthesis, or back into the feed to the reformer to enhance **carbon monoxide** formation in the **synthesis gas**. Any remaining **synthesis gas** not fed to the **carbon dioxide** separator can be converted to **methanol** by hydrogenation in the existing **methanol** synthesis loop along with **carbon dioxide** from the separator and/or imported **carbon dioxide**, and **hydrogen** from the separator. The separated **carbon monoxide** is then reacted with the **methanol** to produce **acetic acid** or an **acetic acid** precursor by a conventional process.

REFERENCE COUNT: 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L3 ANSWER 5 OF 6 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 2001:338470 CAPLUS

DOCUMENT NUMBER: 134:328210

TITLE: **Methanol** plant retrofit for the manufacture of **acetic acid**

INVENTOR(S): Thiebaut, Daniel Marcel; Vidalin, Kenneth Ebennes

PATENT ASSIGNEE(S): Acetex (Cyprus) Limited, Cyprus

SOURCE: PCT Int. Appl., 44 pp.
CODEN: PIXXD2

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 3

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2001032594	A1	20010510	WO 2000-CY4	20001031
W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM				
RW: GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW, AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG				
US 6274096	B1	20010814	US 1999-430888	19991101
US 6232352	B1	20010515	US 2000-547831	20000412
EP 1226103	A1	20020731	EP 2000-972559	20001031
R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL				
NZ 519314	A	20031031	NZ 2000-519314	20001031
NO 2002002063	A	20020626	NO 2002-2063	20020430
US 6781014	B1	20040824	US 2002-129038	20020430

PRIORITY APPLN. INFO.:

US 1999-430888	A	19991101
US 2000-547831	A	20000412
US 1999-430808	A2	19991101
WO 2000-CY4	W	20001031

AB The retrofitting of an existing **methanol** or **methanol** /ammonia plant to make **acetic acid** is disclosed. The existing plant has a reformer to which natural gas or another hydrocarbon and steam (water) are fed and **synthesis gas** produced. All or part of the **synthesis gas** is processed to sep. out **carbon dioxide**, **carbon monoxide**

, and **hydrogen**, and the separated **carbon dioxide** is fed either to the existing **methanol** synthesis loop for **methanol** synthesis, or back into the feed to the reformer to enhance the amount of **carbon monoxide** formation in the **synthesis gas**. Any remaining **synthesis gas** not fed to the **carbon dioxide** separator can be converted to **methanol** in the existing **methanol** synthesis loop along with **carbon dioxide** from the separator and/or imported **carbon dioxide**, and **hydrogen** from the separator. The separated **carbon monoxide** is then reacted with the **methanol** to produce **acetic acid** or an **acetic acid** precursor by a conventional process. Also disclosed is the reaction of separated **hydrogen** with nitrogen, in a conventional manner, to produce ammonia and the reaction of a portion of the **acetic acid** in a conventional manner with oxygen and ethylene to form vinyl acetate. The nitrogen for the added ammonia capacity in a retrofit of an original **methanol** plant comprising an ammonia synthesis loop and the oxygen for the vinyl acetate process are obtained from a new air separation unit; process flow diagrams are presented.

REFERENCE COUNT: 3 THERE ARE 3 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L3 ANSWER 6 OF 6 CAPLUS COPYRIGHT 2004 ACS on STN

ACCESSION NUMBER: 1996:248990 CAPLUS
DOCUMENT NUMBER: 124:346554
TITLE: Manufacture of ethylidene diacetate by hydrocarbonylation of dimethyl ether-containing feeds
INVENTOR(S): Waller, Francis J.; Studer, David W.
PATENT ASSIGNEE(S): Air Products and Chemicals, Inc., USA
SOURCE: U.S., 19 pp., Cont.-in-part of U. S. Ser. No. 963,771, abandoned.
CODEN: USXXAM
DOCUMENT TYPE: Patent
LANGUAGE: English
FAMILY ACC. NUM. COUNT: 4
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 5502243	A	19960326	US 1994-308018	19940916
CA 2093752	AA	19931016	CA 1993-2093752	19930408
CA 2093752	C	19990615		
JP 06025031	A2	19940201	JP 1993-88617	19930415
CA 2158006	AA	19960317	CA 1995-2158006	19950911
CA 2158006	C	19990831		
EP 701990	A1	19960320	EP 1995-306384	19950912
EP 701990	B1	19990310		

R: DE, DK, FR, GB, IT, NL

PRIORITY APPLN. INFO.:

US 1992-870126	A2	19920415
US 1992-963771	B2	19921020
US 1994-308018	A	19940916

AB Ethylidene diacetate and other oxygenated compds. such as **acetic acid**, acetic anhydride, acetaldehyde, and Me acetate are produced in a catalyzed liquid phase reaction system by reacting a feed containing di-Me ether, **methanol**, and **synthesis gas** which contains **hydrogen**, **carbon monoxide**, and **carbon dioxide** in a liquid phase reactor containing at least **acetic acid** and a catalyst system consisting essentially of a Group VIII metal, Me iodide, lithium iodide, and lithium acetate, wherein the molar ratio of **carbon dioxide** to **methanol** in the feed is 5-12. The inclusion of **carbon dioxide** in the **synthesis gas** in selected amts. increases the overall yield of oxygenated acetyl compds. from the reactant

di-Me ether. When **methanol** is included in the reactor feed, the addition of **carbon dioxide** significantly improves the molar selectivity to ethylidene diacetate.